Costs and Outcomes of Integrated Human African Trypanosomiasis Surveillance System Using Rapid Diagnostic Tests, Democratic Republic of the Congo

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We integrated sleeping sickness case detection into the primary healthcare system in 2 health districts in the Democratic Republic of the Congo. We replaced a less field-friendly serologic test with a rapid diagnostic test, which was followed up by human African trypanosomiasis microscopic testing, and used a mixed costing methodology to estimate costs from a healthcare provider perspective. We screened a total of 18,225 persons and identified 27 new cases. Average financial cost (i.e., actual expenditures) was US $6.70/person screened and $4,464/case diagnosed and treated. Average economic cost (i.e., value of resources foregone that could have been used for other purposes) was $9.40/person screened and $6,138/case diagnosed and treated. Our study shows that integrating sleeping sickness surveillance into the primary healthcare system is feasible and highlights challenges in completing the diagnostic referral process and developing a context-adapted diagnostic algorithm for the large-scale implementation of this strategy in a sustainable and low-cost manner.

Sleeping sickness, or human African trypanosomiasis (HAT), is a neglected tropical disease that has killed thousands of persons in sub-Saharan Africa since the beginning of the 20th century. This disease is caused by *Trypanosoma brucei gambiense* and *T. brucei rhodesiense* parasites. This article focuses on *T. brucei gambiense* infections, which account for >98% of all HAT cases (*1*). After intense control efforts during the colonial period, the disease subsided but reemerged in the 1970s and peaked in the 1990s, when >30,000 new cases were reported annually in 1997 and 1998. By the end of the 20th century, increased HAT control efforts reversed the epidemic trend (*2*). This success persuaded the World Health Organization (WHO) to target HAT for elimination as a public health problem by 2020 and to eliminate transmission by 2030 (*3*). In 2018, only 977 new HAT cases were reported globally, >75% of which occurred in the Democratic Republic of the Congo (DRC) (*2*,*4*).

HAT control activities consist of case detection and management complemented with vector control. Case detection can be done actively through outreach campaigns or passively by screening self-reporting cases in medical facilities. The passive approach accounted for >50% of the cases detected in DRC in 2017. With the declining prevalence, and therefore a higher cost of outreach activities on a per-case-found basis, passive screening might figure more prominently in future strategies for HAT elimination (*4*,*5*). Moreover, the past has shown that inadequate HAT surveillance can lead to reemerging epidemics, further underscoring the need for sustained epidemiologic surveillance and case detection in the general health system (*6*,*7*).

Historically, passive detection of HAT in DRC was conducted mainly at designated centers for HAT diagnosis, treatment, and control because of the complexity of diagnostic procedures. Clinical diagnosis of HAT is difficult because of its nonspecific symptoms in the early stages, and HAT needs to be confirmed

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because of the complex and toxic treatment regimens currently available. First, a relatively easy and cheap serologic screening test is performed, which, if positive, is followed by microscopic testing to confirm the presence of the parasite in the lymph fluid or blood. Then, a lumbar puncture is necessary to determine if the disease has advanced to the neurologic stage, given that, until 2019, the treatment regimen was different for cases in the hematolymphatic stage (stage 1) versus those in the meningoencephalitic stage (stage 2) (*1*,*8*,*9*).

Mitashi et al. (*5*) listed the preconditions for the integration of vertical disease control services as follows: a functional health system, versatile health workers, a minimum level of disease prevalence to maintain technical skills; decision-making powers for the health system combined with technical guidance by the disease program, and mutual benefits for the healthcare system and the disease program (*5*,*10*–*12*). This article examined 1 additional criterion, appropriate technology.

In the past, the main serologic test used for trypanosomiasis was the card agglutination test, which requires a rotator and a cold chain and is only available in 50 test dose vials with a limited shelf life once opened (1 week in a refrigerator or up to 8 hours at room temperature). The need for electric power combined with the high wastage given the low daily use, limits the usefulness of this test in first-line health services. In addition, microscopic examination to visualize the parasite requires specific laboratory skills and equipment (*5*,*13*). Recently, 2 rapid diagnostic tests (RDTs) for HAT became commercially available: the SD-Bioline HAT test (Abbot, https://www.globalpointofcare.abbott) and the HAT Sero-K-Set (Coris BioConcept, https://www.corisbio.com). These individual thermostable tests do not require equipment or cold storage and could improve the integration of case detection in the primary healthcare system (*14*). A study in Uganda demonstrated that RDTs would allow HAT screening to be integrated into the routine activities of health facilities (*15*,*16*). A comparison of HAT serologic tests showed that RDTs could be a cost-effective alternative to the card agglutination test in passive detection of trypanosomiasis at health facility level (*17*). Our study aimed to evaluate the results and costs of a HAT surveillance system that was based on RDTs, integrated into primary care facilities, and managed at the health district level.

Methods

Research Setting

Every province in the DRC is divided into health districts that consist of a network of health facilities that each serve a well-defined area of the district (*11*). The study took place in the HAT-endemic health districts of Mosango and Yasa Bonga in the former Bandundu Province in DRC. Both health districts together consist of 38 health areas, have a combined population of 369,393, and represent an area of 6,160 km^2 (Yasa Bonga, 235,696 population and an area of 2,810 km^2; Mosango, 133,697 population and an area of 3,350 km^2) (*18*,*19*). During 2000–2012, a total of 45% of all HAT cases in DRC were reported in Bandundu Province, and during this period, the highest annual incidence reported in both health districts was 40 cases/10,000 population (*20*).

Integrating HAT Case Detection and Management

During the preintervention phase, investments were made to strengthen the infrastructure, equipment, and staff skills before integrating HAT screening because the districts did not meet several integration requirements highlighted by Mitashi et al. (*5*). In addition, research showed that a poorly regulated fee-for-health services payment system could lead to unpredictable health costs for patients, which reduces access to quality healthcare (*9*). Therefore, a flat-rate payment system was introduced to improve financial access to healthcare in both districts.

Before 2015, only 5 facilities in the study area were able to perform serologic and parasitologic tests. The intervention planned for serologic screening in ≥1 health facility per health area and the ability to perform HAT microscopic testing nearby. The facilities were chosen on the basis of HAT incidence during 2013–2015 and population density (Figure 1).

The intervention started with training staff and reinforcing HAT management skills at the health district level. The health district management teams and the experts from the national sleeping sickness control program (Programme National de Lutte contre la Trypanosomiase Humaine Africaine en République Démocratique Du Congo) oversaw training, management, and supply.

The screening algorithm indicated that all patients with a negative malaria test or persistent fever after a malaria treatment or ≥1 signs or symptoms suggestive of HAT (e.g., lymphadenopathy, headache, pruritus, musculoskeletal pain, hepatomegaly, splenomegaly, sleep disorder, and neuropsychiatric symptoms) were to be screened with a HAT RDT (*11*,*20*). HAT microscopic testing was to be conducted for all patients with a positive HAT RDT, either onsite or at the nearest facility with microscopic testing capacity (Figure 2). The microscopic testing consisted of a lymph gland puncture to examine the fluid for

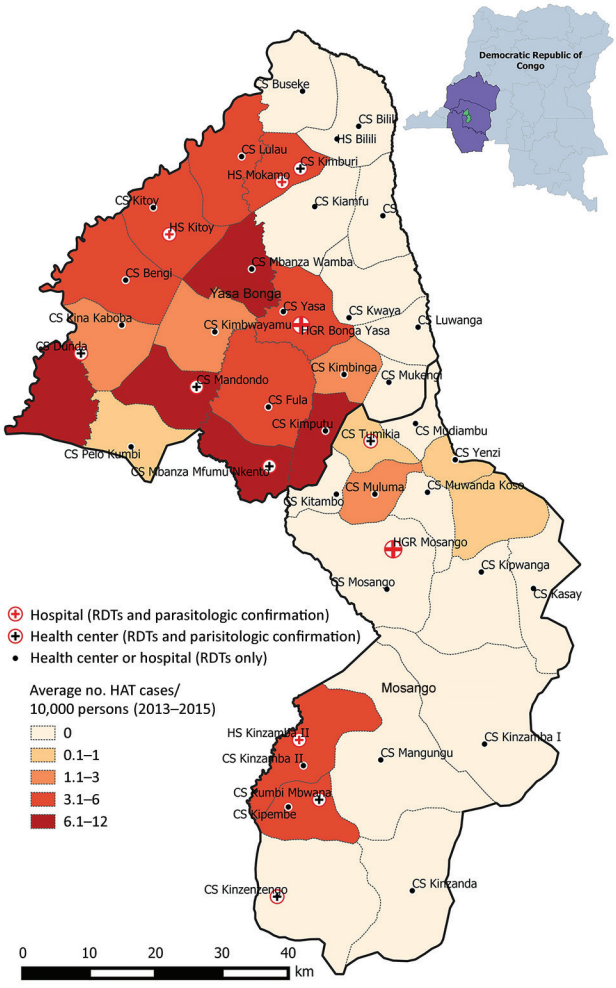


Figure 1. Health facilities performing HAT surveillance and the average human African trypanosomiasis incidence (cases/10,000 population), Democratic Republic of the Congo, 2013–2015. Inset shows location of the country in Africa. Map generated by using QGIS 3.10.1 (*4*). HAT, human African trypanosomiasis; RDT, rapid diagnostic test.

parasites if swollen glands were present, followed by the more sensitive mini anion exchange centrifugation test if no such glands were present or if the result of the lymph gland puncture was negative. Patients were considered to have a confirmed HAT case when trypanosomes were observed. The cerebrospinal fluid of patients was to be examined with a lumbar puncture because of the stage-specific treatment available at the time of the study, followed by treatment according to WHO and national guidelines (*21*–*24*). Stage 1 consisted of outpatient treatment with pentamidine at a health facility close to the patient's home. Stage 2 consisted of inpatient treatment in a health facility qualified to administer nifurtimox/eflornithine combination therapy.

By the end of 2016, integrated HAT surveillance was operational. HAT screening with RDTs was available in 48 facilities, and microscopic diagnostic testing was available in 11 facilities (Table 1) (*25*).

Data Collection and Analysis

We collected data during January 1, 2017–December 31, 2018. Data were based on operational and financial reports, field visits, and discussions with experts.

Number of Persons Screened, Diagnosed, and Treated

The primary indicator for measuring the output of both health districts was the number of persons screened for HAT and cases identified and treated. Of the 1,092 monthly reports expected during the study period from all participating health facilities, 91 reports (8%) were not retrieved. Most of the missing reports coincided with periods when HAT RDTs were out of stock. Therefore, we assumed that no HAT screening activities took place during the unreported months.

Because integrating disease control services requires a functional healthcare system, we tracked the utilization rate for the health district by using the number of curative consultations annually per total population. The DRC's national guidelines state that in a well-functioning health district, this rate should be $\geq$0.5 consultations/capita (*26*).

Financial and Economic Costs

We estimated economic and financial costs from the health provider's perspective. Financial costs represent the actual expenditure, whereas economic costs estimate the value of resources foregone that could have been used for other purposes. Costs incurred by households, research costs, and costs of activities during the preintervention phase were not included.

We recorded all costs in the currency they were incurred and converted to US dollars (USD) based on the average exchange rate during the study period (Euro to USD, 1.15; Congolese Franc to USD, 0.00067). The costs exclude the DRC's 16% value-added tax, from which the national program and donors are exempt (*27*). Transport and importation costs for goods that needed to be imported into DRC were estimated at 10% of the procurement cost on the basis of the average shipment costs between Belgium and DRC during the study period.

We used bottom-up microcosting to assess the cost of HAT tests and equipment. For capital equipment provided for HAT microscopic testing, we annualized the purchase or replacement value on the basis of the expected useful life of items and

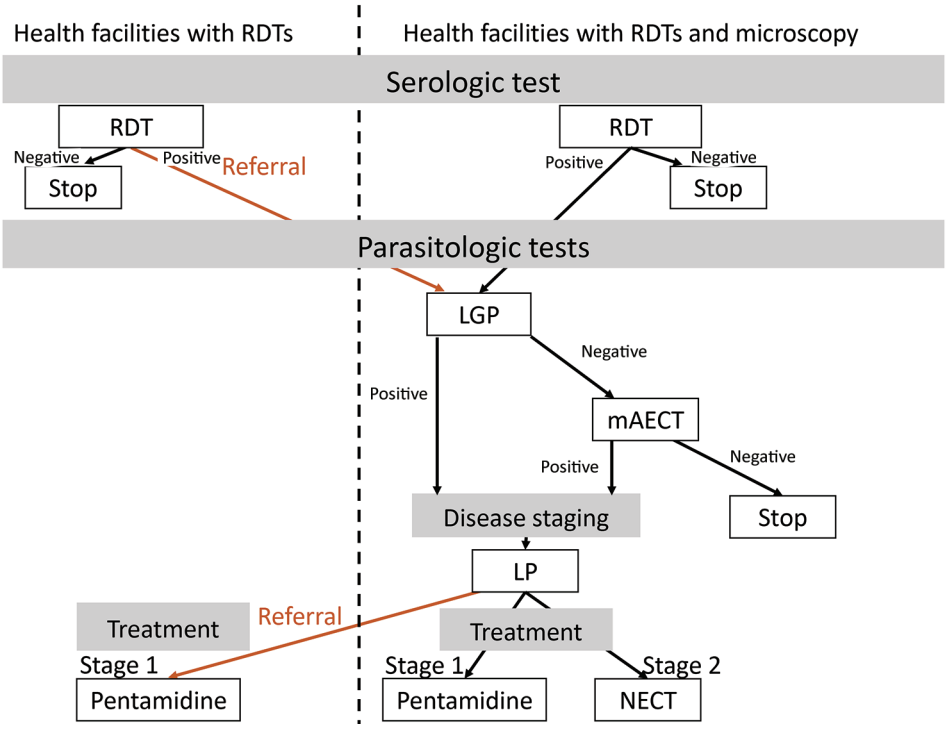


Figure 2. Diagnostic algorithm applied after a negative malaria test, persistent fever after malaria treatment, or symptoms suggestive of human African trypanosomiasis, Democratic Republic of the Congo. LGP, Lymph gland puncture; LP, lumbar puncture; mAECT, mini anion exchange centrifugation test; NEXT, nifurtimox/eflornithine combination therapy; RDT, rapid diagnostic test.

discounted them at a rate of 3% (*28*). We assigned a proportion of this cost to HAT testing on the basis of the expected proportion of time for which the equipment would be used for HAT tests. We estimated the cost of HAT testing by multiplying the number of persons tested by the average cost of all consumables used per test. During the study, we used only SD-Bioline HAT RDTs at a per-unit purchase price of $0.55. SD-Bioline receives a subsidy of $0.25 per test from a private donor. The per-unit price of the HAT RDT Sero-K-set was €1.79 (*17*).

The flat-rate payment system implemented a fixed consultation rate of 5,000 Congolese Francs (± 3.35) that enables health facilities to recover their costs with an average estimated consultation time of 15 minutes. Performing an RDT takes ≈15–20 minutes. The patients did not pay any additional fees nor did the facilities receive any support besides the HAT tests and equipment. We included the consultation fee in the economic cost as a proxy to estimate the costs incurred by health facilities to provide the services (i.e., nurse time and use of facility resources) and the consultation fee was excluded from the financial cost estimate because no actual expenses were incurred.

For HAT treatment, we obtained outpatient follow-up and hospitalization costs from WHO and combined them with the cost for drugs used to treat side effects on the basis of the average costs of the medication during treatment in both districts in 2017. We included no HAT-specific treatment costs because pentamidine and nifurtimox/eflornithine combination therapy are donated by pharmaceutical companies (*29*–*33*).

Table 1. Number of facilities able to perform passive case detection of human African trypanosomiasis per health district before and after implementing the intervention, Democratic Republic of the Congo, 2017–2018 (*25*)

	Before the intervention		After the intervention	
District and type of facility	Serologic screening*	Parasitologic diagnosis†	Serologic screening	Parasitologic diagnosis
Mosango				
Hospital‡	1	1	2	2
Health center			17	2
Yasa Bonga				
Hospital	3	3	4	3
Health center	1	1	25	4
Total	5	5	48	11

*Sleeping sickness rapid diagnostic tests.
†Lymph gland puncture, mini anion exchange centrifugation test, and lumbar puncture.
‡Reference or secondary hospital.

We used top-down gross costing to estimate costs related to training and management. We annualized HAT training costs on the basis of the period between refresher training sessions. For the management costs, we included financial and in-kind support provided to the health facilities and management cost at provincial and health district level. We accounted for management costs of the national program at national level by applying a 15% markup on the activities managed by the program, which corresponds to the overhead rate the program applies for several projects to finance its role as national coordinator of HAT activities. The costs do not include transport costs of test or equipment from the capital city (Kinshasa) to the field because the districts were supplied during regular supervision visits. We estimated the cost per person screened and per case diagnosed and treated by dividing the overall cost of the intervention by the number of persons screened and treated.

Sensitivity Analysis

We used univariate sensitivity analysis to assess the impact of changes in the main cost drivers, such as the costs incurred to provide the services, including the cost of treatment and the price of RDTs. We also varied the discount rate between 0% and 5%.

Ethics

Ethics approval for this study was obtained from the institutional review board of the Institute of Tropical Medicine in Antwerp, Belgium (approval no. IRB/AB/ac/137, protocol no. 115/16) and the institutional review board of School of Public Health of the University of Kinshasa, in Kinshasa, DRC (approval no. ESP/CE/08/2017). The study evaluated costs and aggregated operational data of routine activities provided by the healthcare system. Therefore, no formal consent was needed.

Results

Number of Persons Screened, Confirmatory Tested, Diagnosed, and Treated

Both health districts were considered well-functioning during the study period; the district utilization rate was close to the national threshold of 0.5 consultations per inhabitant per year (0.53 in Yasa Bonga and 0.44 in Mosango). In 2018, only 29% (36,363/125,674) of the overall curative consultations in Yasa Bonga were done in health facilities involved in HAT screening and 77% in Mosango (46,009/59,228) (*18*,*34*), meaning that higher coverage of passive HAT screening was reached in Mosango, and ≈70% of the curative consultations in Yasa Bonga took place in healthcare centers not participating in HAT screening or during periods when no HAT screening was reported. For both districts, >50% of the curative consultations involved testing with a malaria RDT, ≈60% of which tested positive.

In total, 18,225 persons were screened for HAT with a HAT RDT (i.e., ≈80% of persons that tested negative for malaria), of whom 223 [1.22%] tested positive. RDT stock-outs were the main reason that 20% of malaria-negative persons were not tested for HAT. No reports were found indicating that persons were screened for HAT on the basis of persistent fever after a malaria treatment or ≥1 signs or symptoms suggestive of HAT.

In total, 27 new HAT patients were identified through a positive mini anion exchange centrifugation test (no positive lymph gland puncture). Only 55% of the persons with a positive HAT RDT (123/223) were tested to confirm the presence of the parasite, because only 20% (25/122) of the persons with a positive HAT RDT identified in a facility without HAT microscopic testing available completed the referral. In comparison, 97% (98/101) of RDT-positive persons identified in facilities equipped to perform microscopic testing completed confirmation. Of the 27 new cases identified and treated in 2017 and 2018, a total of 9 were detected through healthcare centers and 18 by the reference and secondary hospitals (Appendix Tables 1–4, https://wwwnc.cdc.gov/EID/article/27/8/20-2399-App1.pdf).

Financial Costs

The total annual financial cost for both health districts was US $123,386 in 2017 and $28,710 in 2018; the average annual financial cost over 5 years was $62,500. The higher financial cost in the first year is attributable to staff training and equipment purchases. The financial cost is substantially lower than the economic cost because it does not consider any support for human resources or the use of other resources for the health facilities performing the tests (Appendix Table 5).

Economic Costs

We constructed an overview of the economic costs by input and activity (Table 2). The total economic cost in Mosango is ≈5% higher than in Yasa Bonga because >30% more persons were screened, leading to higher facility and RDT costs. The higher cost in Mosango is partly offset by the lower training costs, because fewer facilities were involved in HAT screening than in Yasa Bonga (Appendix Tables 6–17).

Table 2. Annual economic costs of passive human African trypanosomiasis screening in Mosango and Yasa Bonga health districts, Democratic Republic of the Congo*

Cost category and subcategory	Description	Cost, USD			Total, %
		Mosango	Yasa Bonga	Total	
Capital equipment		18,008	25,051	43,060	25
Equipment	Confirmation equipment	4,734	6,627	11,360	7
	Laboratory equipment	2,539	3,554	6,093	4
	Nonmedical equipment	2,195	3,073	5,268	3
Training	HAT diagnosis training	13,275	18,424	31.699	19
	Screening	5,079	6,950	12,029	7
	Microscopy	8,196	11,474	19,670	12
Annual recurrent costs		69,243	56,764	126,008	75
Laboratory and medical supplies	HAT tests	7,487	5,449	12,262	7
	RDTs	7,388	4,874	12,262	7
	Microscopy	99	575	673	0.4
Patient care	Staging and inpatient and outpatient care	413	1,601	2,014	1
HR and infrastructure use	Execution RDT	36,535	24,102	60,637	36
Management	Management and supervision	24,808	25,613	50,421	30
Total		87,251	81,816	169,067	100
Cost per person screened		7.95	11.29	9.28	
Cost per case diagnosed and treated		21,813	3,557	6,262	

*HAT, human African trypanosomiasis; HR, human resources; RDT, rapid diagnostic test.

Economic Cost Per Person Screened and Per Case Diagnosed and Treated

The overall cost per person screened was $9.28, and the cost per case diagnosed and treated was $6,262 (Figure 3). In Yasa Bonga, the cost per person screened is higher than in Mosango because of the higher number of facilities involved and the lower number of persons screened. However, the average cost per case diagnosed and treated is much lower in Yasa Bonga because of the higher number of cases detected and treated.

Sensitivity Analysis

We summarized the results of the univariate sensitivity analysis of several cost parameters to assess the potential impact on the cost per person screened and cost per case diagnosed and treated (Figure 4). The main cost drivers are the frequency of training and the cost at health facility level to provide this service. The economic cost per person screened or case diagnosed would be much lower if we assume that the health system can provide HAT screening by using fewer additional resources than those needed for a 15-minute consultation (the proxy used to estimate the cost at health facility level, including human resources and infrastructure); however, this approach might overestimate the health system's capacity. A lower estimated unit cost to provide this service of $1 instead of $3.55 would lower the cost per person screened and diagnosed and treated by 25%. Further, the study assumed that healthcare workers needed retraining every 3 years. Increasing the frequency of the laboratory technicians' training increases the cost per person screened and diagnosed and treated by 45%. Reducing the number of facilities where HAT microscopic testing is available decreases the cost per person screened and diagnosed and treated. Using more expensive tests or treatments increases the cost per person. Varying the discount rate from 0% to 5% had little effect on the cost estimates.

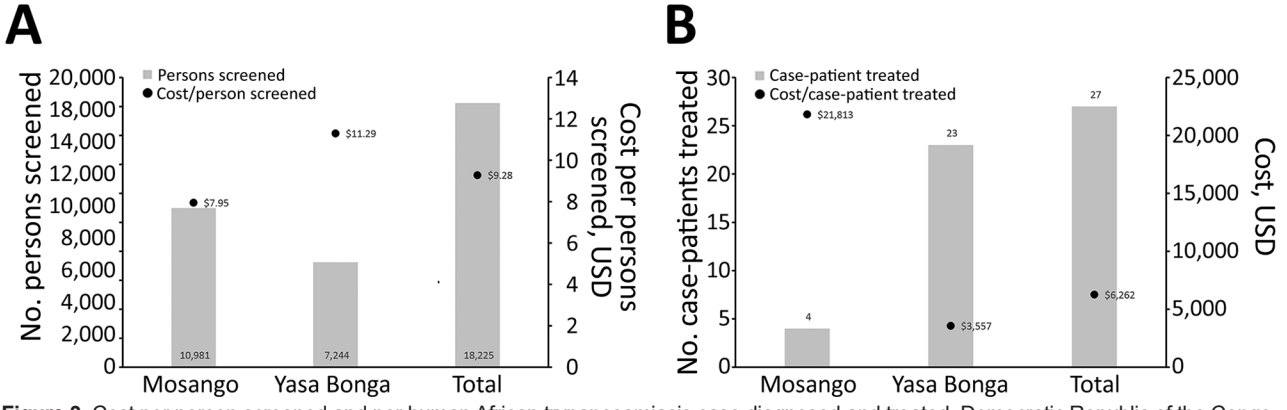


Figure 3. Cost per person screened and per human African trypanosomiasis case diagnosed and treated, Democratic Republic of the Congo.

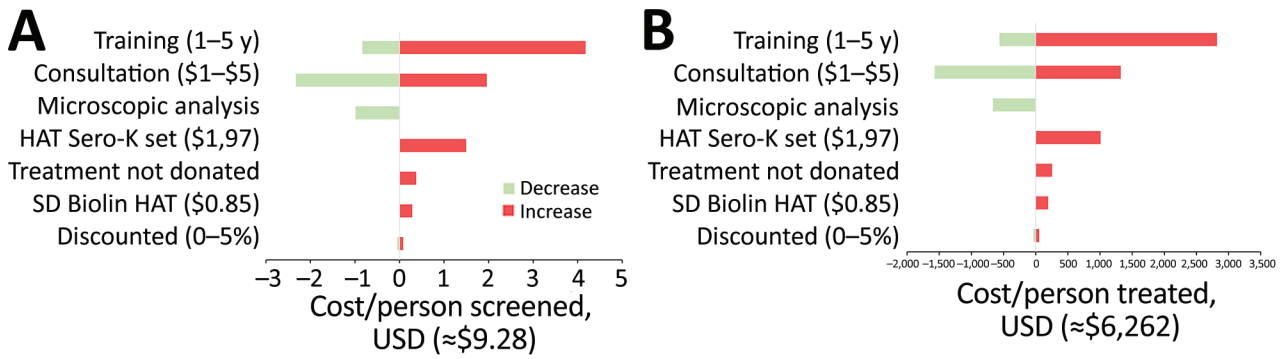
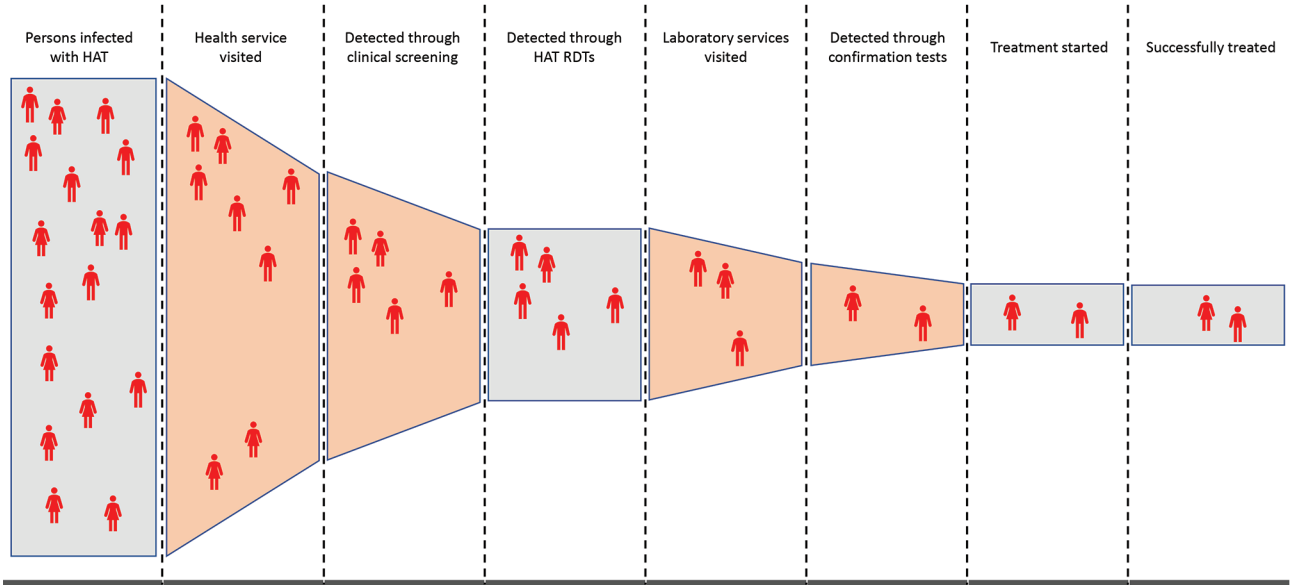


Figure 4. Sensitivity analysis on main cost drivers for HAT diagnosis and treatment, Democratic Republic of the Congo. HAT, human African trypanosomiasis.

Discussion

This study describes the development, implementation, and cost of a strategy for HAT case detection integrated into the primary healthcare system in DRC using a novel screening test. In a context of a declining number of cases combined with a need for sustained surveillance, policymakers need to reflect on the value of integrating HAT screening into the basic health service package offered by polyvalent first-line health services. Introducing HAT RDTs helped integrate HAT screening into the primary healthcare system in both health districts where the program was piloted. Although the number of persons screened almost doubled, the number of cases identified declined, consistent with the observed overall decrease in prevalence in both districts. This decline resulted in an increased cost per person diagnosed and treated. The cost per person diagnosed and treated through passive screening estimated in this study is much higher than the cost per HAT case cured reported in an earlier study that evaluated the cost-effectiveness of screening for HAT with RDTs ($6,262 compared with $278, or $10,133/36.5 cases) (*17*). The earlier study modeled the use of HAT RDTs in a high-vol-



Case-finding efficacy	Health system	Clinical screening	Serologic screening	Attending parasitologic tests	Parasitologic screening	Attending treatment	Successful treatment
System based	Utilization of health services		Availability of HAT RDTs	Functionality referral system	Availability of HAT tests and quality HAT microscopy	Availability of HAT treatment	
Technical aspects		Sensitivity of clinical screening	Sensitivity of HAT RDTs		Sensitivity of parasitologic tests		Efficacy of treatment

Figure 5. Illustration of potential loss in effectiveness in passive screening for HAT integrated into the primary healthcare system using an adaptation of Piot model for tuberculosis (*36*), Democratic Republic of the Congo. HAT, human African trypanosomiasis; RDT, rapid diagnostic test.

ume hospital that screened 2,500 patients annually for HAT and detected 36.5 HAT cases, whereas, in our study in 2018, the average number of persons screened per facility was 206 (9,892 persons/48 facilities), and the average number of cases detected per facility, 0.6 (27 cases/48 facilities), therefore incurred higher fixed facility-level costs (capital and district supervision) for services to fewer patients.

Furthermore, training and management costs were not included in previous studies, and the estimated cost of the use of the facilities' resources was much lower ($1 vs. $3.33 per person screened). The cost per person screened through passive screening in the study area is much higher than through active screening ($9.28 vs. an average of $2.1). However, the average cost per case detected is much lower ($6,318 vs. an average of $16,080) because of the higher proportion of cases detected in the population screened during passive screening than during active screening (*35*).

The effectiveness of this strategy should be evaluated through the number of HAT cases detected and treated. Several potential bottlenecks were identified in the process of HAT case detection (*36*) (Figure 5). The main challenges in the study area were the fact that potential HAT cases were not detected because the person had already tested positive on a malaria RDT or because they did not complete the referral for offsite microscopic testing. Today, a novel therapeutic, fexinidazole, has obviated the need for staging in a portion of patients and could improve the effectiveness of this system; however, there are several contraindications against this treatment (*37*).

The following recommendations should be considered for the scale-up of passive surveillance through RDTs. The HAT screening algorithm should be context-specific, a negative malaria test in a malaria-endemic area might not be a good preselection criterion for HAT screening. Furthermore, the system should be adapted to demand (e.g., it should be located in facilities that are most frequented, exploit the existing referral system to supply HAT test material, and take into account a minimum attendance rate). In the study setting, a separate referral and supply system for HAT was set up and closely monitored by the national program. Shifting most of these tasks to the general healthcare system will probably lower the cost and render the system more sustainable when implemented on a larger scale. The shift in service delivery might also cause a shift in the financing of the system. In this study, the costs at health facility level were borne by the health facilities because they did not receive any additional compensation for the extra time spent on HAT testing, which is reflected in the lower financial cost. Health facilities might be reluctant to participate in HAT activities without any in-kind or financial compensation. A remedy might be to include HAT formally into the performance-based financing system.

In conclusion, HAT case detection and surveillance integrated into the primary healthcare system using RDTs showed promising results but also substantial practical weaknesses. Integration is possible in a sustainable and low-cost manner if challenges regarding completing diagnostic algorithm are addressed and a context-adapted diagnostic algorithm is used.

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Costs and Outcomes of Integrated Human African Trypanosomiasis Surveillance System Using Rapid Diagnostic Tests, Democratic Republic of the Congo

Appendix

Materials and Methods

Function used to estimate the annual financial cost

Total annual financial cost excluding variable management cost (Total annual cost excluding variable management cost x 1.15) =

Purchase/replacement value capital equipment and training

+ People screened x cost Rapid Diagnostic test (Cost for the RDT implementation at health facility level is not taken in account because this is not directly financed by the health care provider)

+ People microscopically confirmed x (cost Blood sample + cost mAECT)

+ Cases x cost lumbar puncture (LP)

+ Stage 1 cases x Cost treatment with pentamidine

+ Stage 2 cases x Cost treatment with NECT

+ Costs for management and supervision

Total annual cost = Total annual cost excluding variable management cost x 1.15

Function used to estimate the annual economic cost

Total annual economic cost excluding variable management cost =

Annualized discounted cost capital equipment and training

+ People screened x cost Rapid Diagnostic test

+ People screened x cost RDT implementation at health facility level

+ People microscopically confirmed x (cost Blood sample (BS) + cost mAECT) (None of the facilities reported any lymph node aspirations done and no cases were diagnosed through lymph node aspirations.)

+ Cases x cost lumbar puncture (LP)

+ Stage 1 cases x Cost treatment with pentamidine

+ Stage 2 cases x Cost treatment with NECT

+ Costs for management and supervision

Total annual economic cost = Total annual economic cost excluding variable management cost x 1.15

Function used to estimate the annualized discounted economic cost of capital equipment

The annualised discounted economic costs of the equipment was calculated by averaging the annual discounted costs based on the useful life of the equipment. For each year (n) in the future the value of costs was multiplied by $1/(1+D)^n$ where D is the discount rate.

For example for a car with a value of 40,000$ with a useful life of 4 years and a discount rate of 3% the annual discounted economic cost would be calculated as followed:

$[10,000 * (1/(1+0.03)^0+1/(1+0.03)^1+1/(1+0.03)^2+/(1+0.03)^3)]/4$

$[10,000 * (1+0.97+0.94+0.92)]/4 = 38,286 /4 = 9,571$

Appendix Table 1. Number of curative consultations, malaria tests and HAT tests performed, and HAT cases detected

Characteristic	Curative consultations	Number of malaria RDTs performed	Malaria RDT negative	Number of HAT RDTs performed	HAT RDT positive	Number of mAECT performed	mAECT positive/ HAT cases
Mosango	91,053	56,266	12,823	10,981	81	18	4
Facilities: RDT & mAECT	17,591	6,849	1,190	1,320	14	11	0
Facilities: RDT only	73,463	49,417	11,634	9,661	67	7	4
Yasa Bonga	63,435	37,452	9,189	7,244	142	105	23
Facilities: RDT & mAECT	20,051	9,829	3,686	3,106	87	87	18
Facilities: RDT only	43,384	27,623	5,503	4,138	55	18	5
Grand Total	154,488	93,718	22,012	18,225	223	123	27

Appendix Table 2. Number of confirmation test done on sleeping sickness seropositives (n = 223)*

		Results microscopy tests					
Characteristic	Not tested	mAECT neg	mAECT pos; Stage 1	mAECT pos; Stage 2	mAECT pos; Stage unknown	Total	Total mAECT pos.
Screened at RDT centers	97 (80%)	16 (13%)	2 (2%)	5 (4%)	2 (2%)	122	9 (36%)
Screened at RDT & mAECT centers	3 (3%)	80 (79%)	1 (1%)	16 (16%)	1 (1%)	101	18 (8%)
Total screened	100 (45%)	96 (43%)	3 (1%)	21 (9%)	3 (1%)	223	27 (22%)

*Total mAECT positives as a proportion of total mAECT tested.

Appendix Table 3. Disease stage* of HAT cases identified in the study facilities in each health district*

	Mosango			Yasa Bonga			Total		
Characteristic	2017	2018	Total	2017	2018	Total	2017	2018	Total
Stage 1	0	0	0	8	3	11	8	3	11
Stage 2	2	0	2	7	4	11	9	4	13
Stage unknown	2	0	2	0	1	1	2	1	3
Grand Total	4	0	4	15	8	23	19	8	27

*Stage 1: hematolymphatic stage of the disease; Stage 2: meningoencephalitic stage of the disease.

Appendix Table 4. Number of curative consultations, malaria tests and HAT tests performed, and HAT cases detected per health facility in 2017 and 2018

	Curative consultations			RDT Malaria			RDT Malaria +			RDT HAT			RDT HAT +			mAECT			New cases		
Characteristic	2017	2018	Total	2017	2018	Total	2017	2018	Total	2017	2018	Total	2017	2018	Total	2017	2018	Total	2017	2018	Total
Mosango	45,045	46,009	91,053	27,966	28,300	56,266	21,173	22,270	43,442	5,725	5,256	10,981	57	24	81	9	9	18	4	-	4
RDT & mAECT	12,077	10,236	22,313	5,464	4,062	9,526	4,229	3,331	7,560	1,328	757	2,085	17	8	25	7	6	13	2		2
CS KINZENZENGO	4,532	3,214	7,746	1,673	1,901	3,574	1,309	1,688	2,997	670	281	951	6	2	8		1	1			
CS KUMBI MBWANA	3,879	1,787	5,666	3,252	1,249	4,501	2,573	1,027	3,600	269	223	492	2	1	3		1	1			
HGR MOSANGO	2,444	3,154	5,598	287	334	621	135	149	284	266	48	314	3	-	3	3		3			
HS/CSR KINZAMBA II	1,222	2,081	3,303	252	578	830	212	467	679	123	205	328	6	5	11	4	4	8	2		2
RDT	32,968	35,773	68,741	22,502	24,238	46,740	16,944	18,939	35,883	4,397	4,499	8,896	40	16	56	2	3	5	2	-	2
CS Mosenge (KINZAMBA II)	4,362	3,712	8,074	1,657	2,114	3,771	1,195	1,181	2,376	617	482	1,099	5	-	5						
CS Camp Pompe/CS Mosango	3,152	3,910	7,062	2,812	2,779	5,591	2,039	2,256	4,295	771	456	1,227	1	-	1						
CS KASAY	3,133	806	3,939	2,270	1,153	3,423	1,804	840	2,644	401	325	726	5	-	5	1		1	1		1
CS KINZAMBA I	2,852	2,508	5,360	1,737	1,624	3,361	1,422	1,288	2,710	212	271	483	1	-	1	1		1	1		1
CS MUDIAMBU	2,628	3,190	5,818	2,084	2,448	4,532	1,427	1,937	3,364	480	501	981	17	4	21						
CS MULUMA	2,506	3,061	5,567	1,480	1,559	3,039	1,217	1,298	2,515	76	59	135	1	2	3						

	Curative consultations			RDT Malaria			RDT Malaria +			RDT HAT			RDT HAT +			mAECT			New cases		
Characteristic	2017	2018	Total	2017	2018	Total	2017	2018	Total	2017	2018	Total	2017	2018	Total	2017	2018	Total	2017	2018	Total
CS YENZI	2,461	2,295	4,756	1,806	1,336	3,142	1,498	1,087	2,585	336	284	620	1	1	2						
CS KITAMBO	2,436	2,523	4,959	2,027	1,887	3,914	1,555	1,595	3,150	275	238	513	1	-	1						
CS MUWANDA KOSO	2,362	2,125	4,487	1,765	1,399	3,164	1,363	1,129	2,492	311	257	568	-	-	-						
CS KIPWANGA	2,277	2,947	5,224	1,824	2,121	3,945	1,284	1,684	2,968	273	397	670	4	-	4						
CS MANGUNGU	2,105	1,649	3,754	1,152	958	2,110	683	734	1,417	295	187	482	1	1	2						
CS KIPEMBE	1,657	2,252	3,909	1,288	1,689	2,977	1,008	1,398	2,406	266	229	495	3	6	9		2	2			
CS KINZANDA	1,037	1,205	2,242	600	871	1,471	449	751	1,200	84	133	217	-	-	-						
CS Mbulu		1,443	1,443		1,019	1,019		709	709		494	494		1	1		1	1			
CS Kumbi Makopa		2,147	2,147		1,281	1,281		1,052	1,052		186	186		1	1						
Yasa Bonga	27,072	36,363	63,435	16,933	20,519	37,452	12,037	16,226	28,263	2,608	4,636	7,244	69	73	142	40	65	105	15	8	23
RDT & mAECT	10,590	11,391	21,981	5,780	5,529	11,309	3,320	3,824	7,144	1,175	2,347	3,522	36	60	96	31	60	91	12	6	18
HGR BONGA YASA	1,978	1,932	3,910	717	726	1,443	217	335	552	319	1,249	1,568	4	17	21	4	17	21	2	3	5
HS KITOY	2,417	1,160	3,577	1,054	550	1,604	615	343	958	94	155	249	17	12	29	17	12	29	7	3	10
HS MOKAMO	2,260	2,283	4,543	1,040	814	1,854	386	361	747	316	475	791	6	12	18	6	12	18	3		3
CS MBANZA MFUMU NKENTO	1,419	2,487	3,906	1,057	1,390	2,447	777	1,079	1,856	124	138	262	1	4	5		4	4			
CS DUNDA	1,101	1,646	2,747	788	913	1,701	538	683	1,221	113	168	281	5	4	9	4	4	8			
CS KIMPUTU	853	697	1,550	670	373	1,043	484	328	812	133	82	215	2	3	5		3	3			
CS MANDONDO	562	1,186	1,748	454	763	1,217	303	695	998	76	80	156	1	8	9		8	8			
RDT	16,482	24,972	41,454	11,153	14,990	26,143	8,717	12,402	21,119	1,433	2,289	3,722	33	13	46	9	5	14	3	2	5
CS YASA	1,335	2,093	3,428	765	1,272	2,037	605	1,072	1,677	80	191	271	5	-	5	1		1			
CS KWAYA	1,235	1,288	2,523	848	776	1,624	704	644	1,348	59	122	181	1	1	2	1		1			
CS KIMBWAYAMU	987	942	1,929	706	623	1,329	561	507	1,068	108	92	200	4	1	5	3	1	4	1		1
CS LULAU	982	1,236	2,218	669	816	1,485	565	718	1,283	105	94	199	2	-	2						
CS MBANZA GOBARI	974	946	1,920	760	769	1,529	646	600	1,246	76	95	171	4	-	4						
CS LUWANGA	969	1,010	1,979	601	704	1,305	403	539	942	119	132	251	-	1	1		1	1			
CS FULA	814	2,096	2,910	656	749	1,405	529	689	1,218	104	54	158	5	1	6						
CS PELO KUMBI	673	759	1,432	378	373	751	303	290	593	28	85	113	1	1	2						
CS KIMBINGA	966	1,255	2,221	525	803	1,328	322	585	907	39	194	233	1	-	1						
CS KIAMFU	941	965	1,906	627	621	1,248	477	450	927	66	201	267	1	-	1	1		1			
CS KINA KABOBA	912	883	1,795	631	718	1,349	513	645	1,158	53	123	176	1	-	1	1		1			
CS BUSEKE	885	978	1,863	665	494	1,159	508	418	926	128	76	204	-	-	-						
CS MBANZA WAMBA	867	862	1,729	750	733	1,483	633	631	1,264	135	115	250	1	-	1						
CS BENGI	814	1,387	2,201	445	975	1,420	397	949	1,346	39	46	85	2	3	5		1	1		1	1
CS BILILI	801	903	1,704	542	635	1,177	447	578	1,025	40	63	103	4	-	4	2		2	2		2
CS KIMBURI	733	993	1,726	461	392	853	253	293	546	68	63	131	-	1	1		1	1			
CS KITOY	760	532	1,292	460	320	780	369	285	654	48	23	71	1	2	3		1	1		1	1
HS BILILI	498	699	1,197	391	629	1,020	254	433	687	93	203	296	-	-	-						
CS MUKENGI	336	883	1,219	273	607	880	228	515	743	45	115	160	-	2	2						
CS MBANZA NGANDA		1,199	1,199		448	448		391	391		49	49		-	-						
CS MATAMBA		1,212	1,212		661	661		573	573		82	82		-	-						
CS KISANGANI		1,851	1,851		872	872		597	597		71	71		-	-						
Grand Total	72,117	82,372	154,488	44,899	48,819	93,718	33,210	38,496	71,705	8,333	9,892	18,225	126	97	223	49	74	123	19	8	27

Appendix Table 5. Annual financial costs of integrated passive screening in Yasa Bonga and Mosango

Assumptions	Activity	2017	2018	Based on the average 2017 - 2018 *Year 3*	*Year 4*	*Year 5*		
Number of people screened annually		8,333	9,892	9,113	9,113	*9,113*		
People tested through microscopy		49	74	123	123	*123*		
Number of people treated stage 1		8	3	6	6	*6*		
Number of people treated stage 2		11	5	8	8	*8*		
Description		2017	2018	Year 3	Year 4	*Year 5*		
Capital Equipment		83,613 $	810 $	2,958 $	61,771 $	*2,958 $*		
Medical and laboratory equipment	Microscopy	13,074 $	810 $	2,958 $	810 $	*2,958 $*		
Data collection equipment	Microscopy	9,578 $	- $	- $	- $	*- $*		
Solar panel (energy source)	Microscopy	12,000 $	- $	- $	12,000 $	*- $*		
Training – Screening	Training RDT	18,579 $			18,579 $			
Training - Parasitological confirmation	Training mAECT	30,382 $			30,382 $			
Annual Recurrent costs		39,773 $	27,900 $	27,970 $	36,792 $	*27,970 $*		
Lab & medical supplies	RDT	5,606 $	6,655 $	6,131 $	6,131 $	*6,131 $*		
Lab & medical supplies	Microscopy	268 $	405 $	339 $	339 $	*339 $*		
Lab & medical supplies	Staging	359 $	151 $	264 $	264 $	*264 $*		
RDT implementation at health facility level	Health facility							
Treatment (Hospitalization & drugs)	Treatment	1,040 $	464 $	759 $	759 $	*759 $*		
Health District level: Management, Support & Supervision (MOH)	Management	6,760 $	6,760 $	6,760 $	6,760 $	*6,760 $*		
Provincial Health Division: Supervision (MOH)	Management	420 $	420 $	420 $	420 $	*420 $*		
Provincial Coordination: Management, Support & Supervision (PNLTHA)	Management	7,664 $	7,664 $	7,664 $	7,664 $	*7,664 $*	Average	
Central Coordination: Management, Support & Supervision (PNLTHA)	Management	17,655 $	5,381 $	5,632 $	14,454 $	*5,632 $*	3 y	5 y
Total		123,386 $	28,710 $	30,928 $	98,563 $	*30,928 $*	61,008 $	62,503 $
Cost per person screened		13.54 $	3.15 $	3.39 $	10.82 $	*3.39 $*	6.69 $	6.86 $
Cost per person treated		8,813 $	2,051 $	2,209 $	7,040 $	*2,209 $*	4,464 $	4,529 $

Appendix Table 6. Total annual economic costs of integrated passive screening in Yasa Bonga and Mosango

Description	Activity	2017 Mosango	2017 Yasa Bonga	2018 Mosango	2018 Yasa Bonga	2017-2018 Mosango	2017-2018 Yasa Bonga	2017-2018 Total
Capital Equipment		9,004 $	12,526 $	9,004 $	12,526 $	18,008 $	25,051 $	43,060 $
Medical and laboratory equipment	Microscopy	1,269 $	1,777 $	1,269 $	1,777 $	2,539 $	3,554 $	6,093 $
Data collection equipment	Microscopy	693 $	970 $	693 $	970 $	1,386 $	1,940 $	3,326 $
Solar panel (energy source)	Microscopy	405 $	567 $	405 $	567 $	809 $	1,133 $	1,942 $
Training – Screening	Training RDT	2,539 $	3,475 $	2,539 $	3,475 $	5,079 $	6,950 $	12,029 $
Training - Parasitological confirmation	Training mAECT	4,098 $	5,737 $	4,098 $	5,737 $	8,196 $	11,474 $	19,670 $
Annual Recurrent costs		35,795 $	24,341 $	33,448 $	32,424 $	69,243 $	56,764 $	126,008 $
Lab & medical supplies	RDT	3,852 $	1,755 $	3,536 $	3,119 $	7,388 $	4,874 $	12,262 $
Lab & medical supplies	Microscopy	49 $	219 $	49 $	356 $	99 $	575 $	673 $
Lab & medical supplies	Staging	76 $	283 $	- $	151 $	76 $	434 $	510 $
RDT implementation at health facility level	Health facility	19,048 $	8,677 $	17,487 $	15,425 $	36,535 $	24,102 $	60,637 $
Treatment (Hospitalization & drugs)	Treatment	337 $	703 $	- $	464 $	337 $	1,167 $	1,504 $
Health District level: Management, Support & Supervision (MOH)	Management	3,380 $	3,380 $	3,380 $	3,380 $	6,760 $	6,760 $	13,520 $
Provincial Health Division: Supervision (MOH)	Management	210 $	210 $	210 $	210 $	420 $	420 $	840 $
Provincial Coordination: Management, Support & Supervision (PNLTHA)	Management	3,832 $	3,832 $	3,832 $	3,832 $	7,664 $	7,664 $	15,328 $
Central Coordination: Management, Support & Supervision (PNLTHA)	Management	5,012 $	5,282 $	4,953 $	5,487 $	9,964 $	10,769 $	20,734 $

Description	Activity	2017 Mosango	2017 Yasa Bonga	2018 Mosango	2018 Yasa Bonga	2017-2018 Mosango	2017-2018 Yasa Bonga	2017-2018 Total
Total			36,866 $	42,452 $	44,949 $	87,251 $	81,816 $	169,067 $
Cost per person screened		7.83 $	14.14 $	8.08 $	9.70 $	7.95 $	11.29 $	9.28 $
Cost per person treated		11,200 $	2,458 $	NA	14,983 $	21,813 $	3,557 $	6,262 $

Appendix Table 7. Economic cost - Capital equipment: Detailed costs of capital equipment for HAT microscopy tests per health facility ($)

Category	Description	No.	Replacement Value excl VAT	Useful life	% of Use allocated to HAT	Annual cost	Annual cost Discounted at 3%	Annual cost Discounted at 5%	Information Source
Medical and laboratory eq.	Microscope incl. accessories - 12V	1	843	5	25%	42 $	40 $	38 $	Invoice2017
Medical and laboratory eq.	Centrifuge - 12V	1	179	2	100%	90 $	88 $	87 $	Invoice2017
Medical and laboratory eq.	Holder mAECT	1	9	1	100%	9 $	9 $	9 $	Invoice2018
Medical and laboratory eq.	Reading Chamber mAECT	2	58	1	100%	117 $	117 $	117 $	Invoice2019
Data collection equipment	PDA & camera incl. accessories	1	798	5.4	100%	148 $	139 $	133 $	Invoice2017
Solar panel (energy source)	Solar panel incl. accessories	1	1,000	3	25%	83 $	81 $	79 $	Invoice2017
Total						489 $	473 $	464 $	

Appendix Table 8. Economic cost - Capital equipment: Detailed training costs: HAT awareness, use HAT RDTs, use PDA

Description	Unit cost ($)	Quantity	Total ($)
Public transport to health zones	30	23	675
Per diem participants	20	90	1,800
Per diem personnel supporting staff coordination	10	12	120
Housing Participants & supporting staff coordination	20	102	2,040
Lunch & coffee breaks	15	102	1,530
Meeting room	100	4	400
Fuel generator 1l/h = >7l/day	1.40	28	39
Office supplies	15	23	338
Printing training module	10	23	225
Other costs	750	1	750
Per diem Central level PNLTHA	85	12	1,020
Fuel −21l/100km - 1100km retour Kinshasa + 100km circulation	1.40	252	353
Total			9,290
		Total cost per structure	413
		Discounted cost (3%) – estimated lifespan 3 y	401
		Discounted cost (5%) – estimated lifespan 3 y	394

Appendix Table 9. Economic cost - Capital equipment: Detailed training costs: HAT microscopy tests

Description	Unit cost ($)	Quantity	Total ($)
Public transport health zones	30	12	360
Per diem participants	20	90	1,800
Per diem supporting staff coordination	10	12	120

Description	Unit cost ($)	Quantity	Total ($)
Housing participants and supporting staff coordination	20	210	4,200
Lunch & coffee breaks	15	210	3,150
Meeting room	50	14	700
Fuel generator 1L/hour, or 7L/day	1.40	28	39
Office supplies	15	12	180
Printing training module	10	12	120
Training equipment (mice, etc.)	1,500	1	1,500
Other costs	500	1	500
Per diem Central level PNLTHA & INRB	85	56	4,760
Fuel central level −21L/100km - 1100km round-trip; to Kinshasa + 100km	1.40	252	353
Total			17,782
		Total cost per structure	1,482
		Discounted cost (3%) - estimated lifespan 3 y	1,439
		Discounted cost (5%) - estimated lifespan 3 y	1,412

Appendix Table 10. Economic cost - Capital equipment: Detailed training costs internships of microscopists with a mobile team

Description	Unit cost ($)	Quantity	Total ($)
Transport Kwilu, Kwango	50	3	150
Allowance/screening tour (10 $/30 d)	300	3	900
Total			1,050
		Total cost per structure	1,050
		Discounted cost (3%) - estimated lifespan 3 y	1,020
		Discounted cost (5%) - estimated lifespan 3 y	1,001

Appendix Table 11. Economic cost - Annual recurrent costs: Detailed costs per test*

Description	Packaging	# Units/ packaging	Price	Currency	Unit price ($)	Import	Unit price in Kinshasa ($)	LGP	BS	mAECT	LP	RDT
Cotton balls	Roll	1	7.00	$	7.00		7.00					
Providone - disinfectant	250 ml	1	5.00	$	5.00		5.00					
Gloves	Box	100	7.00	$	0.07		0.07		1			1
Bin	Piece	1	20.00	$	20.00		20.00					
Kit CATT	Kit CATT	1	0.52	Euro	0.61	x	0.67					
Lancet	Box	200	3.10	Euro	0.02	x	0.02					
Heparinized capillary tubes	Box	100	3.03	Euro	0.04	x	0.04					
Bulb for capillary tubes	Box	100	1.42	Euro	0.02	x	0.02					
Hypodermic needle	Box	100	8.00	$	0.08		0.08	1				
Syringe 5cc	Box	100	7.00	$	0.07		0.07	1			1	
Tropicalized microscope slide	Box	50	4.00	$	0.08		0.08	1				
Cover glass	Box	100	2.00	$	0.02		0.02	1				
Gauze	Box	10	3.50	$	0.35		0.35		0.5			
Adaptor vacutainer tubes	Box	1	0.50	$	0.50		0.50		0.5			
Vacutainer needle	Box	1	0.50	$	0.50		0.50		1			
Heparinized vacutainer tubes	Box	100	35.00	$	0.35		0.35		1			

Description	Packaging	# Units/ packaging	Price	Currency	Unit price ($)	Import	Unit price in Kinshasa ($)	LGP	BS	mAECT	LP	RDT
Plasticine	Sheet	6	30.00	$	5.00		5.00					
Specialized cover glass	Box	10	15.00	$	1.50		1.50				1	
Kit mAECT	Box	1	3.50	Euro	4.13		4.13			1		
Lumbar puncture needle	Piece	1	1.30	$	1.30		1.30				1	
Modified single centrifugation kit	Kit	1	10.00	Euro	11.80		11.80				1	
Collector tube mAECT (price = Kit)	Box	1	3.50	Euro	4.13		4.13				1	
Pipette	Box	500	45.00	$	0.09		0.09				1	
Tips	Box	500	4.24	Euro	0.01	x	0.01					
Microtitration tray	Box	50	20.01	Euro	0.47	x	0.52					
RDT standard diagnostics	Box	25	13.70	$	0.55	x	0.60					1
RDT HAT Sero-K-Set	Box	40	60.80	Euro	1.79	x	1.97					1

*The costs per test was based on the observations regarding the consumables used during active screening activities and market prices during the project.

Appendix Table 12. Economic cost - Annual recurrent costs: Detailed Cost per test

Test	Price subsidized	Price unsubsidized
Lymph node aspiration (LGP)	$ 0.25	NA
Blood sample (BS)	$ 1.35	NA
mAECT	$ 4.13	$ 8.26
Lumbar puncture examination (LP)	$18.89	NA
RDT Standard Diagnostics	$ 0.67	$ 0.92
RDT Sero-K-Set	$ 1.97	NA

Appendix Table 13. Economic cost - Annual recurrent costs: Detailed costs per treatment

Description	Value ($)	Min ($)	Max ($)	Source of information
Cost per day hospitalized	1.64	1.25	2.23	(*1*)
Cost per outpatient visit by hospital level*	0.40	0.29	0.60	(*1*)
Cost pentamidine	-		20.00	Donated (*2*),
Number of days outpatient treatment with pentamidine	10			(*3*)
Cost other drugs administered during treatment with pentamidine	10			Observation patient charts Yasa Bonga & Mosango
Number of days hospitalized during treatment with NECT	10			(*4*)
Cost NECT	-		407	Donated (*4*),
Cost other drugs administered during treatment with NECT	10			Observation patient charts Yasa Bonga & Mosango
Other costs related to a treatment with NECT	58		58	(*5*)

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Appendix 14. Economic cost - Annual recurrent costs: Cost treatment

Total cost per treatment	Value	Minimum	Maximum
Treatment stage 1 - Pentamidine	14	3	36
Treatment stage 2 - NECT	84	13	497

Appendix Table 15. Economic cost - Annual recurrent costs: Detailed costs for management and supervision: Provincial coordination PNLTHA*

Description	Annual cost ($)	Cost/HD** ($)
Global annual budget provincial coordination	67,961	2,265
Annual planning meeting at provincial level (ECP, ECZS, UM)	13,475	449
1 supervision/Semester (2 people - 5 d/mission)	1,117	1,117
Total Provincial Level: Management & Supervision/HZ		3,832

*The coordination of Bandundu Sud dedicates around 30% of their time to passive screening in 18 endemic health districts (HD). Therefore, the estimate amount of their annual budget to be dedicated to passive screening per health zone is 3%. HD, health district.

Appendix Table 16. Economic cost - Annual recurrent costs: Detailed costs for management and supervision: National coordination PNLTHA*

Description	Annual cost ($)	Cost/HD ($)
Management team to support former Bandundu coordination	31,800	265
National Level: 1 supervision/3 y - 3 people - 5 d	1,432	1,432
Total Central Level: Total direct costs		2,227
Total Central Level: Total indirect costs		15%

*Estimates based on the annual costs, budgets and interviews with PNLTHA. The project management team at the central level follows up HAT control activities in the coordinations of Bandundu Nord and Bandundu Sud. We estimated the team spends 2.5% of their time per health district and conducts one supervisory field visit every 3 y. For the PNTLHA management cost at central level a percentage of 15% on the activities managed by the PNLTHA is included.

Appendix Table 17. Economic cost - Annual recurrent costs: Detailed costs for management and supervision: Health district management unit and provincial health authorities*

Description	Annual cost ($)	Cost/HD ($)
Health district level: Management, Support & Supervision	3,380	3,380
Provincial level - DPS: Management, Support & Supervision - 20 endemic health zones Kwilu	4,200	210

*The cost for the HDM and DPS are based on the financial and in-kind support they received throughout the study period.

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